show what an enormous amount of work has been got through in seven years. First of all there is an Annual Report of Progress, in which, without waiting for completed surveys, the general results of each year's work are given, in geology, palæontology, mineralogy, natural history, meteorology, archæology, and economic products of every kind. Then come what are called Miscellaneous Publications and "Bulletins"—little pamphlets giving data in meteorology, topography, natural history, or other information gathered in the course of the Survey. Next we have large quarto monographs, admirably printed and illustrated, devoted to the discussion of the more technical and matured results, such, for instance, as the palæontology of a wide region or of a formation. Lastly, a series of topographical maps of parts of the districts surveyed has been published. These will be of great value as a basis for the general map to be afterwards constructed. Geologists in this country accustomed to the elaborate geological maps issued by our Government, may perhaps at first wonder why geological maps, properly so called, do not appear among the publications of the Geological Survey of the Territories. But the delay in the issuing of a general map is as necessary as it is prudent. A report may be written of what one sees. It is complete in itself; and if it is found to contain errors, these can be corrected in a subsequent report. But a sheet of a geological map must fit accurately to its neighbours. If it is surveyed and published without waiting for the investigation of the surrounding area, it will most probably be found somewhere, at least, erroneous; and to make it harmonise with adjoining sheets may require so much alteration as to demand, perhaps, even the cancelling of the old and the engraving of a new plate. Therefore we are content to wait for Dr. Hayden's geological map of the Territories in confident anticipation that it will be worthy of the high reputation which he and his staff have already gained.

It should be added, that with the most praiseworthy liberality the publications of the Survey are distributed as gifts to learned bodies and scientific men all over the world. All that is asked is that, where possible, the scientific publications of the recipients of the volumes may be sent in exchange. It is to be hoped that this generous spirit has called forth a similar feeling elsewhere, and that the library of the Geological Survey of the Territories is continually augmented by presents from all parts of the world.

ARCH. GEIKIE

FISKE'S "COSMIC PHILOSOPHY"

Outlines of Cosmic Philosophy, based on the Doctrine of Evolution, with Criticisms on the Positive Philosophy. By John Fiske, M.A., LL.B., Assistant Librarian, and formerly Lecturer on Philosophy, at Harvard University. 2 vols. (London: Macmillan and Co., 1874.)

WE have repeatedly expressed our admiration of the system of philosophy which Mr. Spencer is engaged in working out. Mr. Fiske, in giving an outline of this philosophy, has called it *Cosmic;* a name which he thinks peculiarly fitting, because "the term 'Cosmos' *connotes* the orderly succession of phenomena quite as forcibly as it *denotes* the totality of phenomena; and with anything absolute or ontological, with anything save the 'Mundus' or orderly world of phenomena, it has nothing whatever to do." But Mr. Spencer is far from ignoring the absolute, and the ontological element in his speculations has frequently been the subject of criticism; and surely Mr. Fiske goes beyond an account of the orderly succession of phenomena in all that he has to say about the "Infinite Power manifested in the world of phenomena," which he finds that we are clearly bound to symbolise as quasi-psychical rather than as quasi-material, so that we may say with meaning, "God is Spirit, though we may not say, in the materialistic sense, that God is Force."

As the Evolution-Philosophy, which is for the most part but higher science, has swallowed up the rival systems of former times, and now stands itself without a rival, we need not pause to speak of its merits. Our first duty then is to acknowledge that Mr. Fiske has succeeded in giving a very faithful and attractive sketch of Mr. Spencer's philosophy. He has made all the thoughts his own, and has, we should think, secured for himself a recognised place among the most advanced thinkers of our time. But Mr. Fiske claims that his work shall be regarded as more than a mere reproduction of Mr. Spencer's thoughts. It contains "much new matter, both critical and constructive." In relation to the evolution of society, the author supposes he has anticipated what "will doubtless be much more thoroughly and satisfactorily presented by Mr. Spencer in his forthcoming work on Sociology." Without stopping to inquire whether a love of system may not here, as elsewhere, have led to a slight waste of energy and a straining of words, it must without doubt be recognised that Mr. Fiske has expressed with clearness and ability many large and important truths, the recognition of which must have a very healthy and elevating effect. Nothing can be better than for people to reflect that moral progress consists in the continual "adaptation of the desires of each individual to the requirements arising from the coexistent desires of all neighbouring individuals." Again, the superiority of a true philosophy over some modes of thought which still claim to be the most advanced, may be learned from Mr. Fiske's profound appreciation of the vital part played by the Roman Church in the evolution of European civilisation.

The original matter, however, on which the author lays most stress, refers to the genesis of man. He works out a theory as to the part taken by the prolongation of human infancy in originating social evolution, which, in his own words, "is entirely new in all its features." To account for the passage from mere gregariousness to sociality as marked by permanent family groups, is the problem Mr. Fiske has set himself, and his solution is this:—Mr. Wallace has given a most beautiful exposition of the operation of natural selection at that point in the evolution of man from a lower form when variations in intelligence began to be seized on and preserved rather than variations in bodily structure. It was then that our remote progenitors began to clothe their bodies and to prepare their food, that the ape of many devices survived where his perhaps stronger or swifter contemporaries perished. Now, increase in intelligence, says Mr. Fiske, implies increase in size and complexity of brain; and, as a matter of observation, this structure, as it becomes more and more complex, is less and less definitely organised at birth; then arises the phenomenon of infancy. The orang-outang, until about a month old, "lies on its back, tossing about and examining its hands and feet;" with the lowest savages the period of helplessness is much longer, and as civilisation advances, the period during which the child must depend on the parent for support, becomes still longer. Mr. Fiske believes that these considerations supply "a very thorough and satisfactory explanation of the change from gregariousness to sociality." "The prolonged helplessness of the offspring must keep the parents together for longer and longer periods in successive epochs; and when at last the association is so long kept up that the older children are growing mature, while the younger ones still need protection, the family relations begin to become permanent. The parents have lived so long in company that to seek new companionships involves some disturbance of ingrained habits; and meanwhile the older sons are more likely to continue their original association with each other than to establish associations with strangers, since they have common objects to achieve, and common enmities, bequeathed and acquired, with neighbouring families. As the parent dies, the headship of the family thus established devolves upon the oldest, or bravest, or most sagacious male remaining. Thus the little group gradually becomes a clan, the members of which are united by ties considerably stronger than those which ally them to members of adjacent clans, with whom they may indeed combine to resist the aggressions of yet further outlying clans, or of formidable beasts, but towards whom their feelings are usually those of hostile rivalry." "In this new suggestion," says Mr. Fiske, "as to the causes and the effects of the prolonged infancy of man, I believe we have a suggestion as fruitful as the one which we owe to Mr. Wallace," and "the clue to the solution of the entire problem" of the origin of the human race.

Towards the end of the second volume there is a good deal of more or less original matter relating to religion, much of which we think open to serious criticism, but on which we cannot enter here. There is, however, in the writings of Mr. Spencer, a view (adopted by Mr. Fiske) with respect to the relation of feeling to movement which appears to us to be nothing more than a popular fallacy, and which, as it seems to us, spreads much confusion through the psychological part of his system. The assumption against which we would direct some criticism is, that feelings stand in a causal relation to bodily movements. The point has recently occupied some attention, but we must reserve our remarks for another article.

Though we admire the far-reaching speculations of Mr. Spencer as more wonderfully consistent than the thoughts of any other thinker of equal range, we cannot regard his writings as criticism-proof at all points. Mr. Fiske, in arguing against the volitional theory of causation, says: "Phenomenally we know of will only as the cause of certain limited and very peculiar kinds of activity displayed by the nerves and muscles of the higher animals. And to argue from this that all other kinds of activity are equally caused by will . . . is as monstrous a stretch of assumption as can well be imagined." "Because this is the only cause of which we are conscious, . . . we are asked to assume, without further evidence, that throughout the infinitely multitudinous and heterogeneous phenomena of nature no other kind of cause exists. A more amazing example of the audacity of the subjective method could hardly be found." We hope soon to see the evolution philosophy rendered at once more consistent with itself, and able to give to the volitionist a more complete answer than is to be found in this "crushing refutation;" at which the volitionist will but smile, believing the strong language to be but a make-weight to the weak argument. The argument, as it stands, is Mr. Fiske's; it is in the admission made to the volitionist, viz. that certain movements are caused by feeling, that he follows Mr. Spencer. We contrariwise maintain that an antecedent feeling is never the cause of any movement whatever, that there is no evidence of its being so, that the phenomena of life and motion can be wholly accounted for without such assumption; that the assumption, that feeling causes movements, though it can be expressed in words, cannot be represented in thought; and that the thing asserted is inconsistent with the physical explanation of the objective side of the universe—of all physical phenomena, and movements are such—which is a fundamental idea in Mr. Spencer's philosophy. When this is accepted, the answer to the volitionist will be, that he takes for the cause of all action not that which is phenomenally known "only as the cause of certain limited and very peculiar kinds of activity," but that which is not known to be, and cannot be conceived of as, the cause of any activity.

Justice cannot be done to this criticism in a review article in these columns. We shall therefore content ourselves with calling attention to some of the confusion which, as it seems to us, this popular fallacy introduces into the philosophy Mr. Fiske expounds in these volumes. First, let us have no misunderstanding, if that be possible among philosophers. Certain states of consciousness, which precede certain bodily movements, and which are called by the learned "volitions," have in all ages been believed to be the cause of these movements. This opinion is perhaps as ancient as the human mind, more ancient than, and the father of, the earliest conceptions of deity. It is still the all but universal opinion, not of the vulgar, but of the most cultured. Quoting from Mr. J. S. Mill, Mr. Fiske says: "Our will causes our bodily actions in the same sense (and in no other) in which cold causes ice or a spark causes an explosion of gunpowder." In a passage quoted from Sir William Hamilton, also with approval, we have this definite expression: "A multitude of solid and fluid parts must be set in motion by the will."

Now let us in effect deny all this in Mr. Fiske's own words. Speaking of what he calls "the closed circuit of motion, motion, motion," he says: "No conceivable advance in physical discovery can get us out of this closed circuit, and into this circuit psychical phenomena do not enter. Psychical phenomena stand *outside* this circuit, *parallel* with that brief segment of it which is made up of molecular motions in nerve-tissue." "However strict the parallelism may be, within the limits of our experience, between the phenomena of mind and this segment of the circuit of motions, the task of transcending or abolishing the radical antithesis between the phenomena of mind and the phenomena of motions of matter must always remain an impracticable task. For in order to transcend or abolish this radical antithesis we must be prepared to show how a given quantity of molecular motion in nerve-tissue can become transformed into a definable amount of ideation or feeling." Strange that it does not occur to our philosophers that they just leap this impassable gulf from the other side when they talk about a multitude of solid and fluid parts being set in motion by the will, in the same sense in which a spark causes an explosion of gunpowder. Either the volition is itself a mode of motion, which Mr. Fiske solemnly denies, or the circuit is not closed, which he as solemnly asserts it to be.

The inconsistency and consequent error, to which we have called attention, cause much more widespread confusion than might at first be supposed. In one direction we have seen the closed circuit of motion broken in on. In the opposite direction we have elaborate attempts to evolve mind out of matter, all specific and impressive declarations to the contrary notwithstanding. In this direction Mr. Lewes has gone forward with a more uncompromising logic than is to be found in the volumes before us. Mr. Fiske agrees with Mr. Lewes that both "life and mind are processes," but we do not find that he goes on to picture consciousness "as a mass of stationary waves formed out of the individual waves of neural tremors." The evolution philosophy, starting from the primeval nebula, finds every science a specialised part of some more general science. Biology is a specialised part of geology, and psychology is a specialised part of biology. "Mind here appears," says Mr. Fiske, "to be but the highest form of Life," and life, as admirably defined by Mr. Spencer, "is the definite combination of heterogeneous changes, both simultaneous and successive, in correspondence with external co-existences and sequences." Truly the study of the higher forms of these phenomena may be called a specialised part of biology. But may we call any adjustment of internal relations to external relations *Mind?* We think not, and in this Mr. Fiske heartily agrees with us, for he hastens to tell us that "push our researches in biology as far as we may, the most we can ever ascertain is that certain nerve-changes succeed certain other nerve-changes or certain external stimuli in a certain definite order. But all this of itself can render no account of the simplest phenomenon of consciousness." And Mr. Spencer is equally emphatic :—"The thoughts and feeling which constitute a consciousness form an existence that has no place among the existences with which the rest of the sciences deal." But where are we now? If in psychology any part of the phenomena studied are those given directly in consciousness, then they are not the phenomena which form a specialised part of biology. Consciousness, then, is not evolved out of the primeval nebula. It creeps in surreptiously somewhere in the course of the evolution of organised beings, and appears in man, the highest product of evolution, as a power guiding his movements. This, to our mind, is the weak point in Mr. Spencer's philosophy.

Let us glance at Mr. Fiske's chapter on the Evolution of Mind, which he tells us "was mostly written, and the theory contained therein entirely worked out, before the publication of Part V. of the second edition of Mr. Spencer's 'Principles of Psychology.'" In so far as this so-called theory of the evolution of mind is an account of the evolution of the nervous system, it may be open to no serious criticism. But what happens is this : From talking of waves of molecular disturbance passing along finished channels and finding for themselves new courses in lines of least resistance, the language gradually changes ; a process entirely physical, "reflex action, which is unaccompanied by consciousness," is called "the simplest form of psychical life." Instinct is found to be compound reflex action. And in the higher organisms "there will be a number of permanent transit-lines and a number of such lines in process of formation, along with a continual tendency towards the establishment of new ones. The consequences of this are obvious. In becoming more and more complex, the correspondence becomes less and less instantaneous and decided. 'They gradually lose their distinctly automatic character, and that which we call instinct merges into something higher.'" What is the something higher into which all these nervous operations merge? Into mind as we see it in man, who is supposed to perform actions "with the assistance of reason, volition, and conscious memory."

It is, however, when specially engaged with the consideration of voluntary action that the confusion may be said to reach a climax. But Mr. Fiske has no misgiving ; he proceeds, confident that he has clear ideas to expound, and that he is expounding them in clear and consistent language. "Volition," he tells us, "is that transformation of feeling into action which is attended by a conscious comparison of impressions." If *feeling* may be transformed into *action*, why may not motion be transformed into feeling? Having written this he cannot well afford to sneer at the materialist. Though mind and motion, as we are often told, have no kinship, yet here are a few sentences which are perhaps expected to help us towards a mental picture of the curious "dynamic process" "whereby feeling initiates action."—"In a complex aggregate, like the human or animal organism, such a state of equilibrium (as the ass between the two bundles of hay) cannot be of long continuance. Sooner or later—either from the greater vividness with which one of the desired objects is mentally realised, or from any one of a thousand other disturbing circumstances down to those of a purely physical nature—one desire will become stronger than the other, and instantly thereupon, the surplus nervous tension remaining after the weaker desire is neutralised, will pass into nervous *vis viva*, or, in other words, volition will take place." It will be almost a sufficient criticism of these statements to place alongside of them a sentence from Mr. Fiske's next paragraph. "To say explicitly that volition does not follow the strongest motive, is to say implicitly that motion does not always follow the line of least resistance ; which is to deny the persistence of force." With this last statement we agree ; but how is it to be reconciled with the preceding sentences? Can mental vividness, or anything else not purely physical, either help or hinder motion in following the line of least resistance? To say so is to deny the persistence of force.

Having found that philosophers are very like other people, that they are sometimes almost as anxious to be thought infallible as to have any inconsistency in their writings pointed out (Mr. J. S. Mill was a grand exception), it may perhaps be as well to say that in bringing together a few passages which seem to us after careful consideration to be hopelessly inconsistent, we have been inspired by no other feeling than a desire to see the philosophy we admire purified from an error that greatly mars its beauty. Let it be accepted that states of consciousness really stand outside the circuit of motions and therefore can never be a cause of any movement, and the occasion of all the confusion of which we have spoken disappears.

Mr. Spencer, who has been so kind as to read the proof of this article, tells me by letter that he thinks I have not quite remembered his point of view and its implications. He says :—"The implication of your argument seems to be that I identify motion as it actually exists with motion as manifested to our consciousness. Did I do this there would be the inconsistency you allege in the supposition that feeling is transformable into motion and motion into feeling. . . . But that transformation which I assume to take place (though without in the least understanding how) is the transformation of the subjective activity we call feeling (unknowable in its ultimate nature) into the objective activity we call motion (also unknowable in its ultimate nature)." On the metaphysical question my own view probably does not differ much from Mr. Spencer's ; but I would have it kept distinct from the question of ordinary science, which deals only with the relations of things as manifested to our consciousness. And I leave it to Mr. Fiske and his readers to determine whether in the passages I have quoted from his work he means motion and feeling as known to us—the motion and feeling of science, or the ontological entities of the metaphysician, with which in his preface he has told us his system "has nothing whatever to do."

DOUGLAS A. SPALDING

OUR BOOK SHELF

Notes on the Fertilisation of the Cereals. By A. S. Wilson. (Reprinted from the "Transactions of the Botanical Society of Edinburgh.")

NOTWITHSTANDING the practical importance to the farmer of a knowledge of the mode in which our cereal crops are fertilised, it is singular that different views still prevail on several essential particulars. One point appears to be generally conceded, that insects have nothing to do with it ; the ovules are either self-fertilised, or cross-fertilised by the agency of the wind. Dr. Boswell-Syme and the present author incline towards the former ; Delpino and Hildebrand to the latter view, at all events in the case of wheat ; and Belgian farmers still trail ropes over their flowering wheat to insure complete fertilisation. Although we cannot altogether agree with Mr. Wilson's conclusions, he has added some most valuable observations to our knowledge of the subject, especially with regard to the remarkable extension of the filaments immediately previous to, or concurrently with, the discharge of the pollen. If a rye-flower, he states, is opened a moment before the natural time of flowering, the filaments will be found to measure about one-sixteenth of an inch in length. In the course of five minutes, or less, from the instant the pales begin to open, the filaments will, in many cases, have grown to twelve-sixteenths, and the whole of the pollen will have fallen out ; and this rapid extension is not a mere straightening out of a doubled-up thread, but an actual growth. In oats and barley a similar extension takes place ; in the latter case the filaments may be seen, under an ordinary pocket lens, to be visibly growing at the rate of six inches an hour. The result at which Mr. Wilson arrives is, that the "European cereals are self-fertilised, and that the act of fertilisation, in those cases in which the flower opens, is probably performed in the opening, and is necessarily confined to the twenty or thirty minutes during which the flower remains open." We must confess that we are not convinced of the validity of the train of reasoning which led the author to this conclusion. The remarkable phenomenon of the extension of the filaments would appear to be quite useless for this purpose, Mr. Wilson's drawing showing that its effect is to remove the anthers from the immediate proximity of the stigmas to a considerable distance from them. The whole mechanism of the "versatile" anthers, lightly suspended at the end of very slender filaments, the immense quantity of light dry pollen, and the sudden jerk by which the flowers are opened, appear to lead *primâ facie* to an opposite conclusion, and to suggest the agency of the wind. On two other points Mr. Wilson seems to us to have been led into some confusion by an incorrect use of terms. He speaks of the meaning of the word "fertilisation" as being "partly a matter of convention ; it may mean that act of the anthers by which they project or discharge the pollen, which, falling directly on the pistil, shall produce the embryo ; or it may mean the falling of the pollen on the ovule after being carried a distance by the wind ; or it may apply to the instant in which the elements of the pollen set up that action in the ovule which produces a new plant ;" and he employs the word throughout in the first of these meanings. Now we believe that all our best writers use the term as synonymous with "impregnation" or "fecundation ;" and that the correct expression for the falling of the pollen on the stigma—the German "Bestäubung"—is "pollination" ; Mr. Wilson's "fertilisation" being simply the discharge of the pollen from the anther, which may or may not "pollinate" the stigma and "fertilise" the ovules. He also finds fault with those botanists who distinguish between "cross-fertilisation" and "self-fertilisation"—the fertilisation of ovules by pollen from a different or from the same flower—without being able to define accurately the physiological difference between the two processes. The terms are, however, currently used, and we think quite correctly, to express an actual external difference, which we know from experience to be frequently accompanied by results of a different character ; even though we are not at present able to trace this difference to its physiological causes. Notwithstanding these points, to which we have felt bound to call attention, the present treatise is one of the most important contributions yet made to our knowledge of the remarkable phenomena connected with fertilisation.

A. W. B.

Official Guide to the Kew Museums ; a Handbook to the Museums of Economic Botany of the Royal Gardens, Kew. By Daniel Oliver, F.R.S. Sixth edition, with additions by J. R. Jackson, A.L.S., Curator of the Museums. (J. R. Jackson, Museum, Kew. 8vo., 92 pages.)

ALTHOUGH this is by no means a complete catalogue or guide to all the objects exhibited in the museums at Kew, very few substances of commercial importance have been overlooked. Necessarily in so small a book, little is said of the relative value, &c., of different fibres and other vegetable substances ; but it will be found useful to all interested in applied botany, inasmuch as it embodies all recent discoveries of interest to the druggist, manufacturer, or artist. The products are arranged in families according to their affinities, and by means of this guide, which has a complete index of trivial and technical names, the visitor can readily find any article of which he may be in search. One thing, however, is certain, the Government might, by a small grant in aid of a more comprehensive publication, render the fine collection of vegetable products at Kew of infinitely more service to the general public.